# Spherically-symmetric gravitational fields in the metric-affine gauge theory of gravitation

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**Abstract**

Geometric structure of spherically-symmetric space-time in metric-affine gauge theory of gravity is studied. Restrictions on curvature tensor and Bianchi identities are obtained. By using certain simple gravitational Lagrangian the solution of gravitational equations for vacuum spherically-symmetric gravitational field is obtained.

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As it is known, the application of gauge approach to gravitational interaction leads to generalization of Einsteinian theory of gravitation. At present there are different gauge theories of gravitation in dependence on using gauge group corresponding to gravitational interaction. The metric-affine gauge theory of gravitation (MAGT) is one of the most general gauge theories of gravity and it is based on the group of affine transformations A(4,R) as gauge groupe [1]. In MAGT spase-time continuum possesses curvature, torsion and nonmetricity, and as sources of gravitational field are energy-momrntum tensor and so-called hypermomentum which is generalization of spin-momentum tensor of Poincare gauge theory of gravitation (PGT).

The system of gravitational equations of MAGT is complicated system of nonlinear differential equations. Their analysis is simplified in the case of models with high space symmetries. Homogeneous isotropic models in MAGT were investigated in Ref. [2]. In the framework of MAGT spherically-symmetric models are analyzed in present paper.

The geometric structure of space-time in MAGT is determined by three tensors: metrics $g_{\mu\nu}$, torsion $S^{\lambda}{}_{\mu\nu}$ and nonmetricity $Q_{\lambda\mu\nu}$[1]. By using the system of spherical coordinates

[1] $\mu$, $\nu$, ... are holonomic indices; i, k, ... are anholonomic (tetrad) indices. Numerical tetrad indices are denoted by means of a sign ˆ over them.

$(x^0 = ct,\ x^1 = r,\ x^2 = \theta,\ x^3 = \varphi)$, we write metrics in the following form

$$g_{\mu\nu} = \mathrm{diag}(e^{\nu}, -e^{\lambda}, -r^2, -r^2\sin^2\theta), \tag{1}$$

where $\nu = \nu(r,t)$, $\lambda = \lambda(r,t)$ are two functions of radial coordinate r and time t. The structure of tensors $S^{\lambda}{}_{\mu\nu}$ and $Q_{\lambda\mu\nu}$ in spherically-symmetric case was studied in Ref. [3]. The torsion is determined by 8 functions $S_i = S_i(r,t)$ $(i = 1,\ 2,\ \dots 8)$ and nonmetricity — by 12 functions $Q_k = Q_k(r,t)$ $(k = 0,\ 1,\ \dots 11)$. Namely nonvanishing components of tensors $S_{\lambda\mu\nu}$ and $Q_{\lambda\mu\nu}$ are:

$$\begin{gathered}
S_{001} = S_1,\ S_{212} = S_2,\ S_{101} = S_3,\ S_{202} = S_4,\ S_{313} = S_2\sin^2\theta,\\
S_{303} = S_4\sin^2\theta,\ S_{032} = S_5\sin\theta,\ S_{132} = S_6\sin\theta,\\
S_{302} = -S_{203} = S_7\sin\theta,\ S_{312} = -S_{213} = S_8\sin\theta,
\end{gathered} \tag{2}$$

$$\begin{gathered}
Q_{000} = Q_0,\ Q_{001} = Q_1,\ Q_{010} = Q_2,\ Q_{011} = Q_3,\ Q_{110} = Q_4,\\
Q_{111} = Q_5,\ Q_{022} = Q_6,\ Q_{122} = Q_7,\ Q_{220} = Q_8,\ Q_{221} = Q_9,\\
Q_{023} = -Q_{032} = Q_{10}\sin\theta,\ Q_{123} = -Q_{132} = Q_{11}\sin\theta,\\
Q_{033} = Q_6\sin^2\theta,\ Q_{133} = Q_7\sin^2\theta,\ Q_{330} = Q_8\sin^2\theta,\ Q_{331} = Q_9\sin^2\theta.
\end{gathered} \tag{3}$$

Note that functions $S_i$ $(i = 5,\ 6,\ 7,\ 8)$ and $Q_k$ $(k = 10,\ 11)$ have pseudoscalar character. All other components of tensors $S_{\lambda\mu\nu}$ and $Q_{\lambda\mu\nu}$ vanish, with the exception of components connected with components (2) – (3) by symmetry properties of torsion $S_{\lambda\mu\nu} = -S_{\lambda\nu\mu}$ and nonmetricity $Q_{\lambda\mu\nu} = Q_{\mu\lambda\nu}$.

By choosing diagonal tetrad $h^i{}_\mu$ corresponding to metrics (1)

$$h^i{}_\mu = \mathrm{diag}(e^{\frac{\nu}{2}},\ e^{\frac{\lambda}{2}},\ r,\ r\sin\theta), \tag{4}$$

we find anholonomic connection:

$$A^{ik}{}_\mu = h^{k\nu}(\partial_\mu h^i{}_\nu - h^i{}_\lambda \Gamma^{\lambda}{}_{\nu\mu}), \tag{5}$$

where holonomic connection $\Gamma^{\lambda}{}_{\mu\nu} = \left\{{\lambda \atop \mu\nu}\right\} + S^{\lambda}{}_{\mu\nu} + S_{\mu\nu}{}^{\lambda} + S_{\nu\mu}{}^{\lambda} + \frac{1}{2}(Q_{\mu\nu}{}^{\lambda} - Q_{\mu}{}^{\lambda}{}_{\nu} - Q_{\nu}{}^{\lambda}{}_{\mu})$ and $\left\{{\lambda \atop \mu\nu}\right\}$ are Christoffel symbols. Nonvanishing components of connection $A^{ik}{}_\mu$ are:

$$\begin{gathered}
A^{\hat{0}\hat{0}}{}_0 = A_0,\ A^{\hat{0}\hat{0}}{}_1 = A_1,\ A^{\hat{1}\hat{0}}{}_0 = A_2,\ A^{\hat{1}\hat{0}}{}_1 = A_3,\ A^{\hat{2}\hat{0}}{}_2 = A_4,\\
A^{\hat{3}\hat{0}}{}_3 = A_4\sin\theta,\ A^{\hat{0}\hat{1}}{}_0 = A_5,\ A^{\hat{0}\hat{1}}{}_1 = A_6,\ A^{\hat{1}\hat{1}}{}_0 = A_7,\\
A^{\hat{1}\hat{1}}{}_1 = A_8,\ A^{\hat{2}\hat{1}}{}_2 = A_9,\ A^{\hat{3}\hat{1}}{}_3 = A_9\sin\theta,\ A^{\hat{0}\hat{2}}{}_2 = A_{10},
\end{gathered}$$

$$
\begin{gathered}
A^{\hat{0}\hat{3}}{}_{3} = A_{10}\sin\theta,\ A^{\hat{1}\hat{2}}{}_{2} = A_{11},\ A^{\hat{1}\hat{3}}{}_{3} = A_{11}\sin\theta,\ A^{\hat{2}\hat{2}}{}_{0} = A^{\hat{3}\hat{3}}{}_{0} = A_{12}, \\
A^{\hat{2}\hat{2}}{}_{1} = A^{\hat{3}\hat{3}}{}_{1} = A_{13},\ A^{\hat{0}\hat{3}}{}_{2} = A_{14},\ A^{\hat{0}\hat{2}}{}_{3} = -A_{14}\sin\theta,\ A^{\hat{1}\hat{3}}{}_{2} = A_{15}, \\
A^{\hat{1}\hat{2}}{}_{3} = -A_{15}\sin\theta,\ A^{\hat{2}\hat{3}}{}_{0} = -A^{\hat{3}\hat{2}}{}_{0} = A_{16},\ A^{\hat{2}\hat{3}}{}_{1} = -A^{\hat{3}\hat{2}}{}_{1} = A_{17}, \\
A^{\hat{3}\hat{0}}{}_{2} = A_{18},\ A^{\hat{2}\hat{0}}{}_{3} = -A_{18}\sin\theta,\ A^{\hat{3}\hat{1}}{}_{2} = A_{19},\ A^{\hat{2}\hat{1}}{}_{3} = -A_{19}\sin\theta,
\end{gathered}
\tag{6}
$$

where explisit form of functions $A_i$ $(i = 0,\ 2,\ \ldots 19)$ is:

$$
\begin{gathered}
A_0 = \tfrac{1}{2}e^{-\nu}Q_0,\ A_1 = \tfrac{1}{2}e^{-\nu}Q_1,\ A_2 = \tfrac{1}{2}e^{-\frac{1}{2}(\lambda+\nu)}(Q_1 - 2Q_2 + 4S_1 - e^{\nu}\nu'), \\
A_3 = -\tfrac{1}{2}e^{-\frac{1}{2}(\lambda+\nu)}(Q_4 - 4S_3 + e^{\lambda}\dot{\lambda}),\ A_4 = -\tfrac{1}{2r}e^{-\frac{1}{2}\nu}(Q_8 - 4S_4), \\
A_5 = \tfrac{1}{2}e^{-\frac{1}{2}(\lambda+\nu)}(-Q_1 - 4S_1 + e^{\nu}\nu'),\ A_6 = \tfrac{1}{2}e^{-\frac{1}{2}(\lambda+\nu)}(-2Q_3 + Q_4 - \\
4S_3 + e^{\lambda}\dot{\lambda}),\ A_7 = \tfrac{1}{2}e^{-\lambda}Q_4,\ A_8 = \tfrac{1}{2}e^{-\lambda}Q_5,\ A_9 = \tfrac{1}{2r}e^{-\frac{1}{2}\lambda}(2r + Q_9 - 4S_2), \\
A_{10} = \tfrac{1}{2r}e^{-\frac{1}{2}\nu}(Q_8 - 2Q_6 - 4S_4), \\
A_{11} = -\tfrac{1}{2r}e^{-\frac{1}{2}\lambda}(2r - 2Q_7 + Q_9 - 4S_2), A_{12} = \tfrac{1}{2r^2}Q_8, \\
A_{13} = \tfrac{1}{2r^2}Q_9,\ A_{14} = \tfrac{1}{r}e^{-\frac{1}{2}\nu}S_5,\ A_{15} = -\tfrac{1}{r}e^{-\frac{1}{2}\lambda}S_6, \\
A_{16} = \tfrac{1}{r^2}(Q_{10} - S_5 - 2S_7),\ A_{17} = \tfrac{1}{r^2}(Q_{11} - S_6 - 2S_8), \\
A_{18} = \tfrac{1}{r}e^{-\frac{1}{2}\nu}(Q_{10} - S_5),\ A_{19} = -\tfrac{1}{r}e^{-\frac{1}{2}\lambda}(Q_{11} - S_6).
\end{gathered}
\tag{7}
$$

The curvature tensor can be calculated according to his definition:

$$
F^{ik}{}_{\mu\nu} \ = \ 2\partial_{[\mu}A^{ik}{}_{\nu]} \ + \ 2A^{i}{}_{l[\nu}A^{lk}{}_{\mu]}. \tag{8}
$$

In considered case the curvature is determined by 27 functions $F_i$ $(i = 0, 1, \ldots 26)$ depending on functions $\nu$, $\lambda$, $S_i$, $Q_k$:

$$
\begin{gathered}
F^{\hat{0}\hat{0}}{}_{\hat{1}\hat{0}} = F_0,\ F^{\hat{0}\hat{1}}{}_{\hat{1}\hat{0}} = F_1,\ F^{\hat{0}\hat{2}}{}_{\hat{2}\hat{0}} = F^{\hat{0}\hat{3}}{}_{\hat{3}\hat{0}} = F_2,\ F^{\hat{0}\hat{2}}{}_{\hat{2}\hat{1}} = F^{\hat{0}\hat{3}}{}_{\hat{3}\hat{1}} = F_3, \\
F^{\hat{1}\hat{0}}{}_{\hat{1}\hat{0}} = F_4,\ F^{\hat{1}\hat{1}}{}_{\hat{1}\hat{0}} = F_5,\ F^{\hat{1}\hat{2}}{}_{\hat{2}\hat{0}} = F^{\hat{1}\hat{3}}{}_{\hat{3}\hat{0}} = F_6,\ F^{\hat{1}\hat{2}}{}_{\hat{2}\hat{1}} = F^{\hat{1}\hat{3}}{}_{\hat{3}\hat{1}} = F_7, \\
F^{\hat{2}\hat{0}}{}_{\hat{2}\hat{0}} = F^{\hat{3}\hat{0}}{}_{\hat{3}\hat{0}} = F_8,\ F^{\hat{2}\hat{0}}{}_{\hat{2}\hat{1}} = F^{\hat{3}\hat{0}}{}_{\hat{3}\hat{1}} = F_9,\ F^{\hat{3}\hat{1}}{}_{\hat{3}\hat{0}} = F^{\hat{2}\hat{1}}{}_{\hat{2}\hat{0}} = F_{10},
\end{gathered}
$$

$$
\begin{gathered}
F^{\hat{3}\hat{1}}{}_{\hat{3}\hat{1}} = F^{\hat{2}\hat{1}}{}_{\hat{2}\hat{1}} = F_{11},\ F^{\hat{2}\hat{2}}{}_{\hat{1}\hat{0}} = F^{\hat{3}\hat{3}}{}_{\hat{1}\hat{0}} = F_{12},\ -F^{\hat{3}\hat{2}}{}_{\hat{3}\hat{2}} = F^{\hat{2}\hat{3}}{}_{\hat{3}\hat{2}} = F_{13},\\
F^{\hat{0}\hat{0}}{}_{\hat{3}\hat{2}} = F_{14},\ F^{\hat{0}\hat{1}}{}_{\hat{3}\hat{2}} = F_{15},\ F^{\hat{1}\hat{0}}{}_{\hat{3}\hat{2}} = F_{16},\ F^{\hat{1}\hat{1}}{}_{\hat{3}\hat{2}} = F_{17},\\
F^{\hat{2}\hat{0}}{}_{\hat{3}\hat{0}} = -F^{\hat{3}\hat{0}}{}_{\hat{2}\hat{0}} = F_{18},\ F^{\hat{2}\hat{0}}{}_{\hat{3}\hat{1}} = -F^{\hat{3}\hat{0}}{}_{\hat{2}\hat{1}} = F_{19},\ F^{\hat{0}\hat{2}}{}_{\hat{3}\hat{0}} = -F^{\hat{0}\hat{3}}{}_{\hat{2}\hat{0}} = F_{20},\\
F^{\hat{0}\hat{2}}{}_{\hat{3}\hat{1}} = -F^{\hat{0}\hat{3}}{}_{\hat{2}\hat{1}} = F_{21},\ F^{\hat{3}\hat{1}}{}_{\hat{2}\hat{0}} = -F^{\hat{2}\hat{1}}{}_{\hat{3}\hat{0}} = F_{22},\ F^{\hat{3}\hat{1}}{}_{\hat{2}\hat{1}} = -F^{\hat{2}\hat{1}}{}_{\hat{3}\hat{1}} = F_{23},\\
F^{\hat{1}\hat{2}}{}_{\hat{3}\hat{1}} = -F^{\hat{1}\hat{3}}{}_{\hat{2}\hat{1}} = F_{24},\ F^{\hat{1}\hat{2}}{}_{\hat{3}\hat{0}} = -F^{\hat{1}\hat{3}}{}_{\hat{2}\hat{0}} = F_{25},\ F^{\hat{3}\hat{2}}{}_{\hat{1}\hat{0}} = -F^{\hat{2}\hat{3}}{}_{\hat{1}\hat{0}} = F_{26},\\
F^{\hat{2}\hat{2}}{}_{\hat{3}\hat{2}} = F^{\hat{3}\hat{3}}{}_{\hat{3}\hat{2}} = \tfrac{1}{2}(F_{14} - F_{17}).
\end{gathered}
\tag{9}
$$

Explicit form of functions $F_i$ is

$$
\begin{gathered}
F_0 = \tfrac{1}{2}e^{-\frac{3}{2}(\lambda+\nu)}[-4Q_3S_1 - e^{\lambda}(\dot{Q}_1 - Q_0' + Q_0\nu' + Q_2\dot{\lambda} -\\
Q_1\dot{\nu}) + Q_2(2Q_3 - Q_4 + 4S_3) + Q_3(e^{\nu}\nu' - Q_1)],\\
F_1 = \tfrac{1}{4}e^{-(\lambda+2\nu)}[Q_0(Q_4 - 2Q_3 - 4S_3 + e^{\lambda}\dot{\lambda}) + Q_1(Q_1 + 4S_1 + e^{\nu}\lambda')] +\\
\tfrac{1}{4}e^{-(2\lambda+\nu)}\{Q_5(Q_1 + 4S_1) + Q_4^2 + e^{\lambda}[4\dot{Q}_3 - 2\dot{Q}_4 + 8\dot{S}_3 - 2Q_1' - 8S_1' +\\
4S_1(\lambda' + \nu') - e^{\nu}(\lambda'\nu' + \nu'^2 + 2\nu'') - (4S_3 + 2Q_3 - Q_4)(\dot{\lambda} + \dot{\nu}) +\\
Q_4\dot{\lambda} - e^{\lambda}(\dot{\lambda}^2 + 2\ddot{\lambda} - \dot{\lambda}\dot{\nu})] - Q_4(2Q_3 + 4S_3) - e^{\nu}Q_5\nu'\},\\
F_2 = -\tfrac{1}{4r^4}e^{-(\lambda+\nu)}\{r^2(2r - 2Q_7 + Q_9 - 4S_2)(4S_1 + Q_1 - e^{\nu}\nu') +\\
e^{\lambda}[4S_5(Q_{10} - S_5 - 2S_7) - Q_8^2 + 2r^2(\dot{Q}_8 - 2\dot{Q}_6 - 4\dot{S}4 + 2S_4\dot{\nu}) +\\
Q_8(4S_4 + 2Q_6 - r^2\dot{\nu}) + 2r^2Q_6\dot{\nu}]\} - \tfrac{1}{4r^2}e^{-2\nu}Q_0(2Q_6 - Q_8 + 4S_4),\\
F_3 = -\tfrac{1}{4r^2}e^{-\frac{1}{2}(\lambda+\nu)}[\tfrac{4}{r^2}S_5(Q_{11} - S_6 + 2S_8) - 8S_4' + 8S_4\nu' + 2(Q_8' - 2Q_6' +\\
2\nu'Q_6 + \nu'Q_8)] + \tfrac{1}{4r^2}e^{-\frac{3}{2}\lambda-\nu}(2r + Q_9 - 2Q_7 - 4S_4)(Q_4 - 2Q_3 - 4S_3 +\\
e^{\lambda}\dot{\lambda}) - \tfrac{1}{4r^2}e^{-\frac{1}{2}\lambda-\frac{3}{2}\nu}(2Q_6 - Q_8 + 4S_4)[Q_1 + e^{\nu}(\tfrac{2}{r} + \tfrac{1}{r^2}Q_9 - \nu')],\\
F_4 = \tfrac{1}{4}e^{-(\lambda+2\nu)}[Q_1^2 + Q_0(Q_4 - 4S_3 + e^{\lambda}\dot{\lambda}) + Q_1(4S_1 - 2Q_2 - e^{\nu}\lambda' -\\
2e^{\nu}\nu')] + \tfrac{1}{4}e^{-(2\lambda+\nu)}\{Q_5(Q_1 + 4S_1) + Q_4^2 + e^{\lambda}[2\dot{Q}_4 - 8\dot{S}_3 + 4S_3(\dot{\lambda} + \dot{\nu}) +\\
e^{\lambda}(\dot{\lambda}^2 + 2\ddot{\lambda} - \dot{\lambda}\dot{\nu}) - Q_4\dot{\nu} + 2Q_1' - 4Q_2' + 8S_1' + (2Q_2 - 4S_1)(\lambda' +\\
\nu') + e^{\nu}(\lambda'\nu' - \nu'^2 - 2\nu'')] - 2Q_2Q_5 - 4Q_4S_3 - e^{\nu}Q_5\nu'\},
\end{gathered}
\tag{10}
$$

$$F_5=\tfrac{1}{2}e^{-\frac{3}{2}(\lambda+\nu)}[Q_3(e^\nu\nu'-Q_1-4S_1)+e^\nu(Q_5\dot{\lambda}-\dot{Q}_5+Q_4'-Q_4\lambda')+$$
$$Q_2(2Q_3-Q_4+4S_3-e^\lambda\dot{\lambda})],$$
$$F_6=-\tfrac{1}{4r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(-r^2e^{-\lambda}Q_4+Q_8+r^2\dot{\lambda})(2r-2Q_7+$$
$$Q_9-4S_2)+S_6(-4Q_{10}+4S_5+8S_7)+r^2(4\dot{Q}_7-2\dot{Q}_9+8\dot{S}_2)+$$
$$r^2(2Q_6-Q_8+4S_4)(-\nu'+e^{-\nu}Q_1+4e^{-\nu}S_1-2e^{-\nu}Q_2)],$$
$$F_7=-\tfrac{1}{4r^4}[-e^{-2\lambda}r^2Q_5(2r-2Q_7+Q_9-4S_2)+e^{-(\lambda+\nu)}r^2(2Q_6-Q_8+4S_4)$$
$$(4S_3-Q4-e^\lambda\dot{\lambda})]-\tfrac{1}{4r^4}e^{-\lambda}[Q_9(4r+Q_9-4S_2)-8rS_2+4S_6(S_6-Q_{11}+$$
$$2S_8)+2r^2(2Q_7'-Q_9'+4S_2'+\lambda'r+\tfrac{1}{2}\lambda'Q_9-2\lambda'S_2)-2Q_7(Q_9+2r+r^2\lambda')],$$
$$F_8=\tfrac{1}{4r^4}e^{-\nu}[(Q_8-4S_4)(Q_8+e^{-\nu}r^2Q_0-r^2\dot{\nu})-4(Q_{10}-S_5)(Q_{10}-S_5-$$
$$2S_7)+2r^2(\dot{Q}_8-4\dot{S}_4)+e^{-\lambda}r^2(2r+Q_9-4S_2)(Q_1-2Q_2+4S_1-e^\nu\nu')],$$
$$F_9=\tfrac{1}{4r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(Q_8-4S_4)(Q_9-2r+e^{-\nu}r^2Q_1-r^2\nu')-4(Q_{10}-S_5)(Q_{11}-$$
$$S_6-2S_8)-e^{-\lambda}r^2(2r+Q_9-4S_2)(Q_4-4S_3+e^\lambda\dot{\lambda})+2r^2(Q_8'-4S_4')],$$
$$F_{10}=-\tfrac{1}{4r^4}e^{-\frac{1}{2}(\lambda+\nu)}\{(2r+Q_9-4S_4)[Q_8-e^{-\lambda}r^2(Q_4+e^\lambda\dot{\lambda})]-4(Q_{11}-$$
$$S_6)(Q_{10}-S_5-2S_7)+2r^2(\dot{Q}_9-4\dot{S}_2)+e^{-\nu}r^2(Q_8-4S_4)(Q_1+4S_1-e^\nu\nu')\},$$
$$F_{11}=-\tfrac{1}{4r^4}e^{-\lambda}[4r^2-4(Q_{11}-S_6)(Q_{11}-S_6-2S_8)+$$
$$e^{-\nu}r^2(Q_8-4S_4)(2Q_3-Q_4+4S_3-e^\lambda\dot{\lambda})+2r^2(Q_9'-4S_2')+$$
$$(2r+Q_9-4S_2)(Q_9-2r-r^2e^{-\lambda}Q_5-r^2\lambda')],$$
$$F_{12}=-\tfrac{1}{2r^3}e^{-\frac{1}{2}(\lambda+\nu)}[2Q_8+r(\dot{Q}_9-Q_8')].$$
$$F_{13}=-\tfrac{1}{r^2}+\tfrac{1}{4r^4}e^{-\lambda}[(2r+Q_9-4S_2)(2r-2Q_7+Q_9-4S_2)+4S_6(S_6-$$
$$Q_{11})]-\tfrac{1}{4r^4}e^{-\nu}[(Q_8-4S_4)(Q_8-2Q_6-4S_4)+4S_5(S_5-Q_{10})],$$
$$F_{14}=\tfrac{1}{r^4}e^{-\nu}[Q_{10}(Q_8-2Q_6-4S_4)+2Q_6S_5],$$
$$F_{15}=-\tfrac{1}{r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(Q_{11}-S_6)(Q_8-2Q_6-4S_4)+S_5(2r+Q_9-4S_2)],$$
$$F_{16}=-\tfrac{1}{r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(Q_{10}-S_5)(2r-2Q_7+Q_9-4S_2)+S_6(Q_8-4S_4)],$$
$$F_{17}=\tfrac{1}{r^4}e^{-\lambda}[Q_{11}(2r-2Q_7+Q_9-4S_2)+2Q_7S_6],$$

$$F_{18} = \frac{1}{2r^4}e^{-\nu}\{(Q_8 - 4S_4)(Q_{10} - S_5 - 2S_7) + 2r^2(\dot{Q_{10}} - \dot{S}_5) + (Q_{10} -$$

$$S_5)[Q_8 + e^{-\nu}r^2(Q_0 - e^{\nu}\dot{\nu})] + e^{-\lambda}r^2(Q_{11} - S_6)(Q_1 - 2Q_2 + 4S_1 - e^{\nu}\nu')\},$$

$$F_{19} = \frac{1}{2r^4}e^{-\frac{1}{2}(\lambda+\nu)}\{(Q_{10} - S_5)[Q_9 - 2r + e^{-\nu}r^2(Q_1 - e^{\nu}\nu')] + (Q_8 - 4S_4)$$

$$(Q_{11} - S_6 - 2S_8) - e^{-\lambda}r^2(Q_{11} - S_6)(Q_4 - 4S_3 + e^{\lambda}\dot{\lambda}) + 2r^2(Q'_{10} - S'_5)\},$$

$$F_{20} = -\frac{1}{2r^4}\{e^{-2\nu}r^2Q_0S_5 - e^{-(\lambda+\nu)}r^2S_6(Q_1 + 4S_1) + e^{-\nu}[-Q_{10}(2Q_6 - Q_8 +$$

$$4S_4) - 2Q_8S_7 + (S_5 + 2S_7)(4S_4 + 2Q_6) - 2r^2\dot{S}_5 + r^2S_5\dot{\nu}] + e^{-\lambda}r^2S_6\nu'\},$$

$$F_{21} = \frac{1}{2r^4}e^{-\frac{3}{2}\lambda-\frac{1}{2}\nu}S_6[r^2(2Q_3 - Q_4 + 4S_3) + e^{\lambda}(Q_8 - 2Q_6 - 4S_4 - r^2\dot{\lambda})] +$$

$$\frac{1}{r^4}e^{-\frac{1}{2}(\lambda+\nu)}[\tfrac{1}{2}Q_{11}(2Q_6 - Q_8 + 4S_4) + S_8(Q_8 - 2Q_6 - 4S_4) + r^2S'_5] -$$

$$\frac{1}{2r^4}e^{-\frac{1}{2}\lambda-\frac{3}{2}\nu}S_5[r^2Q_1 + e^{\nu}(Q_9 + 2r + r^2\nu')],$$

$$F_{22} = -\frac{1}{2r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(Q_{11} - S_6)(e^{-\lambda}r^2Q_4 + r^2\dot{\lambda} - Q_8) - (2r + Q_9 - 4S_2)(Q_{10} -$$

$$S_5 - 2S_7) - 2r^2(\dot{Q_{11}} - \dot{S}_6) + e^{-\nu}r^2(Q_{10} - S_5)(-Q_1 - 4S_1 + e^{\nu}\nu')],$$

$$F_{23} = -\frac{1}{2r^4}e^{-\lambda}[(Q_{11} - S_6)(2r - Q_9 + e^{-\lambda}r^2Q_5 + r^2\lambda') - (2r + Q_9 - 4S_2)(Q_{11} -$$

$$S_6 - 2S_8) - e^{-\nu}r^2(Q_{10} - S_5)(2Q_9 - Q_4 + 4S_3 - e^{\lambda}\dot{\lambda}) - 2r^2(Q'_{11} - S'_6)],$$

$$F_{24} = \frac{1}{2r^4}e^{-2\lambda-\nu}\{e^{\lambda}r^2S_5(Q_4 - 4S_3) - r^2e^{\nu}Q_5S_6 + e^{\lambda+\nu}[2S_6(Q_7 +$$

$$2S_2) + (Q_{11} - 2S_8)(2r - 2Q_7 + Q_9 - 4S_2) + r^2S_6\lambda' - 2r^2S'_6] + e^{2\lambda}r^2S_5\dot{\lambda}\},$$

$$F_{25} = \frac{1}{2r^4}e^{-\frac{1}{2}(\lambda+\nu)}[Q_8S_6 + (2r - 2Q_7 + Q_9 - 4S_2)(Q_{10} - 2S_7 - e^{\nu}S_5) +$$

$$r^2(S_6\dot{\lambda} - 2\dot{S}_6) + r^2S_5(2Q_2 - Q_1 - 4S_1 + e^{\nu}\nu')] - \frac{1}{2r^2}e^{-\frac{1}{2}(3\lambda+\nu)}Q_4S_6,$$

$$F_{26} = \frac{1}{r^3}e^{-\frac{1}{2}(\lambda+\nu)}[2Q_{10} - 2S_5 - 4S_7 + r(\dot{S}_6 - 2\dot{S}_8 - Q'_{10} + S'_5 + 2S'_7)].$$

Let us consider Bianchi identities, which can be written in the following form:

$$\varepsilon^{\sigma\lambda\mu\nu}\nabla_{\lambda}F^{i}{}_{k\mu\nu} = 0. \tag{11}$$

where $\nabla$ is differential operator defined analogously to covariant derivative determinet by means of Cristoffel symbols or connection $(-A^{ik}{}_{\mu})$ in case of holonomic and anholonomic indices respectively:

$\nabla_{\lambda}F^{i}{}_{k\mu\nu} = \partial_{\lambda}F^{i}{}_{k\mu\nu} + A^{l}{}_{k\lambda}F^{i}{}_{l\mu\nu} - A^{i}{}_{l\lambda}F^{l}{}_{k\mu\nu} - \left\{{\sigma \atop \mu\lambda}\right\}F^{i}{}_{k\sigma\nu} - \left\{{\sigma \atop \nu\lambda}\right\}F^{i}{}_{k\mu\sigma}$, and $\varepsilon^{\sigma\lambda\mu\nu}$ is Levi-Chivita symbol.

In spherically-symmetric case Bianchi identities are reduced to 20 relations:

$$e^{\frac{1}{2}(\lambda+\nu)}(4F_{14}+2r^2F'_{14})+e^{\lambda}[2F_{19}(2Q_6-Q_8+4S_4)-$$

$$2F_{21}(Q_8-4S_4)+4F_3(Q_{10}-S_5)-4F_9S_5+r^2\dot{\lambda}(F_{15}+F_{16})]+$$

$$r^2[(F_{15}+F_{16})(Q_4-4S_3)-2F_{16}Q_3]=0,$$

$$-rF_{15}(e^{\lambda}rQ_1+e^{\nu}rQ_5)+e^{\lambda+\nu}[2F_{21}(2r+Q_9-4S_2)+4rF_{15}-4F_3(Q_{11}-$$

$$S_6)+2r^2F'_{15}]+e^{\frac{1}{2}(\lambda+\nu)}[-e^{\lambda}(2F_{23}(2Q_6-Q_8+4S_4)+$$

$$4F_{11}S_5)+r^2(F_{17}+F_{14})(Q_4-2Q_3-4S_4+e^{\lambda}\dot{\lambda})]=0,$$

$$rF_{16}(e^{\lambda}rQ_1+e^{\nu}rQ_5)+2e^{\lambda+\nu}[2rF_{16}+F_{19}(2r-2Q_7+Q_9-4S_2)+$$

$$2F_9S_6+r^2F'_{16}]+e^{\frac{1}{2}(\lambda+\nu)}[r^2(F_{17}+F_{14})(Q_4-4S_3+e^{\lambda}\dot{\lambda})+$$

$$e^{\lambda}F_{24}(8S_4-2Q_8+4Q_{10}-4S_5)]=0,$$

$$4rF_{17}+2(F_{24}-F_{23})(2r-2Q_7+Q_9-4S_2)+4F_{24}Q_7-4F_7(Q_{11}-S_6)+$$

$$4F_{11}S_6+e^{-\frac{1}{2}(\lambda+\nu)}r^2[(F_{15}+F_{16})(Q_4-4S_3+e^{\lambda}\dot{\lambda})-2F_{16}Q_3)]+2r^2F'_{17}=0,$$

$$4r(F_{14}-F_{17})-4F_{23}Q_7+2(F_{23}-F_{24})(2r+Q_9-4S_2)+$$

$$e^{\frac{1}{2}(\lambda-\nu)}[4F_{19}Q_6+2(F_{19}+F_{21})(-Q_8+4S_4)+$$

$$4F_3(Q_{10}-S_5)-4F_9S_5]+4F_7(Q_{11}-S_6)-4F_{11}+2r^2(F'_{14}-F'_{17})=0,$$

$$4rF_{13}+(F_{11}-F_7)(2r+Q_9-4S_2)-2F_{11}Q_7+$$

$$e^{\frac{1}{2}(\lambda-\nu)}[(Q_8-4S_4)(F_9-F_3)-2F_9Q_6-2F_{21}(Q_{10}-S_5)-2F_{19}S_5]-$$

$$2F_{24}(Q_{11}-S_6)+2F_{23}S_6+2r^2F'_{13}=0,$$

$$2e^{\frac{1}{2}(\lambda+\nu)}[(4S_4-Q_8)(F_{18}+F_{20})+2Q_6F_{18}+2F_2(Q_{10}-S_5)-$$

$$2F_8S_5+r^2\dot{F_{14}}]-r^2(F_{15}+F_{16})(Q_1+4S_1-e^{\nu}\nu')+2r^2F_{15}Q_2=0,$$

$$-r^2F_{15}(e^{\lambda}Q_0+e^{\nu}Q_4)+2e^{\frac{1}{2}(\lambda+3\nu)}[F_{20}(2r+Q_9-4S_2)-2F_2(Q_{11}-S_6)]-$$

$$2e^{\lambda+\nu}[F_{22}(2Q_6-Q_8+4S_4)+2F_{10}S_5-r^2\dot{F_{15}}]-$$

$$e^{\frac{1}{2}(\lambda+\nu)}r^2(F_{14}+F_{17})(Q_1+4S_1-e^{\nu}\nu')=0,$$

$$
\begin{aligned}
&r^2F_{16}(e^{\lambda}Q_0+e^{\nu}Q_4)+2e^{\frac{1}{2}(\lambda+3\nu)}[F_{18}(2r-2Q_7+Q_9-4S_2)+F_8S_6]+\\
&2e^{\lambda+\nu}[-F_{25}(Q_8-4S_4)+2F_6(Q_{10}-S_5)+r^2\dot{F_{16}}]-\\
&e^{\frac{1}{2}(\lambda+\nu)}r^2(F_{14}+F_{17})(Q_1-2Q_2+4S_1-e^{\nu}\nu')=0,\\
&e^{\nu}[4F_6(S_6-Q_{11})+2(F_{25}-F_{22})(2r+Q_9-4S_2)+4F_{22}Q_7+\\
&4F_{10}S_6+r^2\nu'(F_{15}+F_{16})]+r^2[2F_{15}Q_2-\\
&(Q_1+4S_1)(F_{15}+F_{16})]+2e^{\frac{1}{2}(\lambda+\nu)}r^2\dot{F_{17}}=0,\\
&e^{\frac{1}{2}\lambda}[2F_2(Q_{10}-S_5)+F_{18}(2Q_6-Q_8+4S_4)+F_{20}(4S_4-Q_8)-\\
&2F_8S_5+r^2(\dot{F_{14}}-\dot{F_{17}})]+e^{\frac{1}{2}\nu}[2F_6(Q_{11}-S_6)+\\
&(F_{22}-F_{25})(2r+Q_9-4S_2)-2Q_7F_{22}-2F_{10}S_6]=0,\\
&e^{\frac{1}{2}(\nu-\lambda)}[(F_6-F_{10})(2r+Q_9-4S_2)+2F_{10}Q_7+2F_{25}(Q_{11}-S_6)-2F_{22}S_6]+\\
&(F_2-F_8)(Q_8-4S_4)+2F_8Q_6+2F_{20}(Q_{10}-S_5)+2F_{18}S_5-2r^2\dot{F_{13}}=0,\\
&e^{\frac{1}{2}(\lambda+3\nu)}[F_2(-Q_9+2r+r^2\nu')+F_1(2r-2Q_7+Q_9-4S_2)-4F_{20}(Q_{11}-\\
&S_6-2S_8)+4r^2F_2']+2e^{\frac{1}{2}(\lambda+\nu)}r^2[F_7(Q_1+4S_1-e^{\nu}\nu')-F_2Q_1]+\\
&2e^{\lambda}r^2F_3Q_0+2e^{\lambda+\nu}[F_3(Q_8-r^2\dot{\lambda})+(F_0+F_{12})(2Q_6-Q_8+4S_4)-2F_{26}S_5+\\
&2F_{21}(Q_{10}-S_5-2S_7)+r^2(-2\dot{F_3}+F_6\dot{\lambda})]-2e^{\nu}r^2F_6(2Q_3-Q_4+4S_3)=0,\\
&\tfrac{1}{r}e^{\frac{1}{2}\nu}[F_{20}(-2r+Q_9)+F_1S_6-2F_2(Q_{11}-S_6+2S_8)-r^2(2F_{20}'+\\
&F_{20}\nu')]-e^{\frac{1}{2}\lambda-\nu}rF_{21}Q_0+e^{-\frac{1}{2}\nu}r[F_{20}Q_1+F_{24}(-Q_1+4S_1+e^{\nu}\nu')]+\\
&\tfrac{1}{r}e^{\frac{1}{2}\lambda}[-F_{21}Q_8+F_{26}(-2Q_6+Q_8-4S_4)-2S_5(F_0+F_{12})+2F_3(Q_{10}-\\
&S_5-2S_7)+r^2(2\dot{F_{21}}+F_{21}\dot{\lambda})]-e^{-\frac{1}{2}\lambda}rF_{25}(-2Q_3+Q_4-4S_3+e^{\lambda}\dot{\lambda})=0,\\
&e^{\lambda+\nu}[(F_{12}-F_5)(2r-2Q_7+Q_9-4S_2)+2F_{26}S_6-2F_{25}(Q_{11}-S_6-2S_8)+\\
&2r^2F_6'+F_6(-Q_9+2r+r^2\nu')]+e^{\frac{1}{2}(\lambda+\nu)}r^2[Q_4(F_2-F_7)-4F_2S_3]+\\
&e^{\frac{1}{2}(3\lambda+\nu)}[2F_4(Q_6+2S_4)+Q_8(F_7-F_4)+2F_{24}(Q_{10}-S_5-2S_7)+r^2(-2\dot{F_7}+\\
&\dot{\lambda}F_2-\dot{\lambda}F_7)]+e^{\lambda}r^2F_3(Q_1-2Q_2+4S_1-e^{\nu}\nu')+e^{\nu}r^2F_6Q_5=0,
\end{aligned}
\tag{12}
$$

$$-e^{\lambda+\nu}[F_{26}(2r-2Q_7+Q_9-4S_2)-2S_6(F_{12}-F_5)+2F_6(Q_{11}-S_6-$$

$$2S_8)+2r^2F'_{25}+F_{25}(-Q_9+2r+r^2\nu')]-e^{\frac{1}{2}(\lambda+\nu)}r^2[Q_4(F_{20}-F_{24})-$$

$$4F_{20}S_3]-e^{\frac{1}{2}(3\lambda+\nu)}[F_{24}Q_8+2F_4S_5-2F_7(Q_{10}-S_5-2S_7)+r^2(-2\dot{F}_{24}+$$

$$\dot{\lambda}F_{20}-\dot{\lambda}F_{24})]-e^{\lambda}r^2F_{21}(Q_1-2Q_2+4S_1-e^{\nu}\nu')-e^{\nu}r^2F_{25}Q_5=0,$$

$$e^{\frac{1}{2}\nu}[-2F_8-2rF'_8-r\nu'(F_8-F_{11})]+e^{-\frac{1}{2}\nu}r[-F_8Q_1+F_{11}(-Q_1+2Q_2-$$

$$4S_1)]+e^{\frac{1}{2}\lambda-\nu}rF_9Q_0+e^{\frac{1}{2}\lambda}r[2\dot{F}_9+\dot{\lambda}(F_9-F_{10})]-e^{-\frac{1}{2}\lambda}rF_{10}(Q_4-4S_3)+$$

$$\frac{1}{r}e^{\frac{1}{2}\lambda}[F_9Q_8+(F_0+F_{12})(Q_8-4S_4)+2(F_{26}-F_{19})(Q_{10}-S_5)+4F_{19}S_7]+$$

$$\frac{1}{r}e^{\frac{1}{2}\nu}[-F_8Q_9+F_4(2r+Q_9-4S_2)+2F_{18}(Q_{11}-S_6-2S_8)]=0,$$

$$e^{\frac{1}{2}\nu}[2F_{10}+2rF'_{10}+r\nu'(F_{10}-F_9)]+e^{-\frac{1}{2}\nu}rF_9(Q_1+4S_4)+$$

$$e^{-\frac{1}{2}\lambda}r[F_{11}Q_4+F_8(-2Q_3+Q_4-4S_3)]-e^{\frac{1}{2}\lambda}r[2\dot{F}_{11}+\dot{\lambda}(F_{11}-F_8)]-$$

$$e^{-\lambda+\frac{1}{2}\nu}rF_{10}Q_5-\frac{1}{r}e^{\frac{1}{2}\lambda}[F_{11}Q_8+\frac{1}{2}F_1(Q_8-4S_4)-2F_{23}(Q_{10}-$$

$$S_5-2S_7)]+\frac{1}{r}e^{\frac{1}{2}\nu}[F_{10}Q_9+(F_{12}-F_5)(2r+Q_9-4S_2)+$$

$$2(F_{26}+F_{22})(Q_{11}-S_6)-4F_{22}S_8]=0,$$

$$-e^{\frac{1}{2}\lambda-\nu}rF_{19}Q_0+e^{\frac{1}{2}\nu}[2F_{18}+2rF'_{18}+r\nu'(F_{18}+F_{23})]+e^{-\frac{1}{2}\nu}r[F_{18}Q_1+$$

$$F_{23}(-Q_1+Q_2-4S_1)]-e^{-\frac{1}{2}\lambda}rF_{22}(Q_4-4S_3)-e^{\frac{1}{2}\lambda}r[2\dot{F}_{19}+\dot{\lambda}(F_{19}+F_{22})]-$$

$$\frac{1}{r}e^{\frac{1}{2}\lambda}[F_{19}Q_8+F_{26}(Q_8-4S_4)-2(F_0+F_{12}+F_9)(Q_{10}-S_5)+4F_9S_7]+$$

$$\frac{1}{r}e^{\frac{1}{2}\nu}[F_{18}Q_9+2(F_4-F_8)(-Q_{11}+S_6)-4F_8S_8]=0,$$

$$-e^{\frac{1}{2}\nu-\lambda}rF_{22}Q_5+e^{\frac{1}{2}\nu}[2F_{22}+2rF'_{22}+r\nu'(F_{22}+F_{19})]-e^{-\frac{1}{2}\nu}rF_{19}(Q_1+4S_1)+$$

$$e^{-\frac{1}{2}\lambda}r[F_{23}Q_4-F_{18}(-2Q_3+Q_4-4S_3)]-e^{\frac{1}{2}\lambda}r[2\dot{F}_{23}+\dot{\lambda}(F_{23}+F_{18})]-$$

$$\frac{1}{r}e^{\frac{1}{2}\lambda}[F_{23}Q_8-(F_1-2F_{11})(Q_{10}-S_5)-4F_{11}S_7]+\frac{1}{r}e^{\frac{1}{2}\nu}[F_{22}Q_9+$$

$$F_{26}(2r+Q_9-4S_2)+2(F_5-F_{12}-F_{10})(Q_{11}-S_6)+4F_{10}S_8]=0.$$

In the case of vanishing pseudoscalar functions $S_i$ $(i=5,\ \dots 8)$ and $Q_i(i=10,11)$ the curvature tensor is determined by 14 functions $\tilde{F}_i(i=0,1,\dots 13)$ (othes functions $F_i(i=$

14, ... 26) are equal to zero), expressions of which follow from (9):

$$F^{\hat 0\hat 0}{}_{\hat 1\hat 0}=\tilde F_0,\ F^{\hat 0\hat 1}{}_{\hat 1\hat 0}=\tilde F_1,\ F^{\hat 0\hat 2}{}_{\hat 2\hat 0}=F^{\hat 0\hat 3}{}_{\hat 3\hat 0}=\tilde F_2,\ F^{\hat 0\hat 2}{}_{\hat 2\hat 1}=F^{\hat 0\hat 3}{}_{\hat 3\hat 1}=\tilde F_3,$$
$$F^{\hat 1\hat 0}{}_{\hat 1\hat 0}=\tilde F_4,\ F^{\hat 1\hat 1}{}_{\hat 1\hat 0}=\tilde F_5,\ F^{\hat 1\hat 2}{}_{\hat 2\hat 0}=F^{\hat 1\hat 3}{}_{\hat 3\hat 0}=\tilde F_6,\ F^{\hat 1\hat 2}{}_{\hat 2\hat 1}=F^{\hat 1\hat 3}{}_{\hat 3\hat 1}=\tilde F_7,$$
$$F^{\hat 2\hat 0}{}_{\hat 2\hat 0}=F^{\hat 3\hat 0}{}_{\hat 3\hat 0}=\tilde F_8,\ F^{\hat 2\hat 0}{}_{\hat 2\hat 1}=F^{\hat 3\hat 0}{}_{\hat 3\hat 1}=\tilde F_9,\ F^{\hat 2\hat 1}{}_{\hat 2\hat 0}=F^{\hat 3\hat 1}{}_{\hat 3\hat 0}=\tilde F_{10}, \tag{13}$$
$$F^{\hat 2\hat 1}{}_{\hat 2\hat 1}=F^{\hat 3\hat 1}{}_{\hat 3\hat 1}=\tilde F_{11},\ F^{\hat 2\hat 2}{}_{\hat 0\hat 1}=F^{\hat 3\hat 3}{}_{\hat 0\hat 1}=\tilde F_{12},\ -F^{\hat 3\hat 2}{}_{\hat 3\hat 2}=F^{\hat 2\hat 3}{}_{\hat 3\hat 2}=\tilde F_{13},$$

where explicit form of functions $\tilde F_i$ is:

$$\tilde F_0=\tfrac{1}{2}\{e^{-\frac{3}{2}(\lambda+\nu)}[-Q_3(4S_1+Q_1)+Q_2(2Q_3-Q_4+4S_3)]+$$
$$e^{-\frac{1}{2}(\lambda+3\nu)}(-\dot Q_1-Q_2\dot\lambda+Q_1\dot\nu+Q_0'-Q_0\nu')+e^{-\frac{1}{2}(3\lambda+\nu)}Q_3\nu'\},$$
$$\tilde F_1=\tfrac{1}{4}\{e^{-\lambda-2\nu}[Q_1^2+Q_0(-2Q_3+Q_4-4S_3+e^\lambda\dot\lambda)+4Q_1S_1]+$$
$$e^{-2\lambda-\nu}[Q_5(Q_1+4S_1-e^\nu\nu')+Q_4(Q_4-2Q_3-4S_3)]+e^{-(\lambda+\nu)}[4\dot Q_3-$$
$$2\dot Q_4+8\dot S_3+Q_1\lambda'+(\dot\lambda+\dot\nu)(Q_4-4S_3-2Q_3)+Q_4\dot\lambda-2Q_1'-$$
$$8S_1'+4S_1(\lambda'+\nu')+e^\lambda(-\dot\lambda^2+\dot\lambda\dot\nu-2\ddot\lambda)]-e^{-\lambda}(-\lambda'\nu'+\nu'^2+2\nu'')\},$$
$$\tilde F_2=-\tfrac{1}{4r^4}\{e^{-(\lambda+\nu)}r^2(2r-2Q_7+Q_9-4S_2)(Q_1+4S_1-e^\nu\nu')+$$
$$e^{-\nu}[(-Q_8+4S_4+2Q_6)(Q_8+r^2\dot\nu)+r^2(-4\dot Q_6+2\dot Q_8-$$
$$8\dot S_4)]+e^{-2\nu}r^2Q_0(2Q_6-Q_8+4S_4)\}, \tag{14}$$
$$\tilde F_3=\tfrac{1}{4r^2}\{e^{-\frac{1}{2}(\lambda+\nu)}[-\tfrac{1}{r^2}(2r+Q_9)(2Q_6-Q_8+4S_4)+8S_4'-8S_4\nu'+4Q_6'-$$
$$2Q_8'-4\nu'Q_6+2\nu'Q_8]+e^{-\frac{1}{2}(3\lambda+\nu)}(2r-2Q_7+Q_9-4S_2)(-2Q_3+$$
$$Q_4-4S_1+e^\lambda\dot\lambda)+e^{-\frac{1}{2}(\lambda+3\nu)}(2Q_6-Q_8+4S_4)(-Q_1+e^\nu\nu')\},$$
$$\tilde F_4=\tfrac{1}{4}\{e^{-\lambda-2\nu}[Q_0(Q_4-4S_3+e^\lambda\dot\lambda)+Q_1(Q_1-2Q_2+4S_1-e^\nu\lambda'-$$
$$2e^\nu\nu')]+e^{-2\lambda-\nu}[Q_4(Q_4-4S_3)+Q_5(Q_1+4S_1-2Q_2)]+e^{-\lambda-\nu}[2\dot Q_4-$$
$$8\dot S_3+4S_3(\dot\lambda+\dot\nu)-Q_4\dot\nu+2Q_1'-4Q_2'+8S_1'+(\lambda'+\nu')(2Q_2-4S_1)]+$$
$$e^{-\nu}(\dot\lambda^2-\dot\lambda\dot\nu+2\ddot\lambda)-e^{-2\lambda}Q_5\nu'+e^{-\lambda}(\lambda'\nu'-\nu'^2-2\nu'')\},$$

$$\tilde{F}_5 = \tfrac{1}{2}e^{-\frac{3}{2}(\lambda+\nu)}[-Q_3(Q_1+4S_1) + e^{\nu}(-\dot{Q}_5 + Q_5\dot{\lambda} + Q_4' -$$

$$Q_4\lambda' + Q_3\nu') + Q_2(2Q_3 - Q_4 + 4S_3 - e^{\lambda}\dot{\lambda})],$$

$$\tilde{F}_6 = -\tfrac{1}{4r^4}\{r^2 e^{-\frac{1}{2}(\lambda+3\nu)}(2Q_6 - Q_8 + 4S_4)(Q_1 + 4S_1 -$$

$$e^{\nu}\nu' - 2Q_2) + e^{-\frac{1}{2}(\lambda+\nu)}[(2r - 2Q_7 + Q_9 - 4S_2)(Q_8 + r^2\dot{\lambda} -$$

$$e^{-\lambda}r^2 Q_4) + r^2(4\dot{Q}_7 - 2\dot{Q}_9 + 8\dot{S}_2)]\},$$

$$\tilde{F}_7 = -\tfrac{1}{4r^4}\{-e^{-2\lambda}r^2(Q_5 - e^{\lambda}\lambda')(2r - 2Q_7 + Q_9 - 4S_2) +$$

$$e^{-\lambda-\nu}r^2(2Q_6 - Q_8 + 4S_4)(4S_3 - Q_4 - e^{\lambda}\dot{\lambda}) + e^{-\lambda}[Q_9(4r + Q_9 -$$

$$4S_2) - 8rS_2 + r^2(4Q_7' - 2Q_9' + 8S_2') - 2Q_7(2r + Q_9)]\},$$

$$\tilde{F}_8 = \tfrac{1}{4r^4}\{e^{-\nu}[(Q_8 + e^{-\nu}r^2 Q_0 - r^2\dot{\nu})(Q_8 - 4S_4) + 2r^2(\dot{Q}_8 - 4\dot{S}_4)] +$$

$$e^{-\lambda-\nu}r^2(2r + Q_9 - 4S_2)(Q_1 - 2Q_2 + 4S_1 - e^{\nu}\nu')\},$$

$$\tilde{F}_9 = \tfrac{1}{4r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(Q_8 - 4S_4)(Q_9 - 2r + e^{-\nu}r^2 Q_1 - r^2\nu') -$$

$$e^{-\lambda}r^2(2r + Q_9 - 4S_2)(Q_4 - 4S_3 + e^{\lambda}\dot{\lambda}) + 2r^2(Q_8' - 4S_4')],$$

$$\tilde{F}_{10} = -\tfrac{1}{4r^4}e^{-\frac{1}{2}(\lambda+\nu)}[(2r + Q_9 - 4S_2)(Q_8 - e^{-\lambda}r^2 Q_4 - r^2\dot{\lambda}) +$$

$$2r^2(\dot{Q}_9 - 4\dot{S}_2) + e^{-\nu}r^2(Q_8 - 4S_4)(Q_1 + 4S_1 - e^{\nu}\nu')],$$

$$\tilde{F}_{11} = -\tfrac{1}{4r^4}e^{-\lambda}\{r^2[4 + e^{-\nu}(Q_8 - 4S_4)(2Q_3 - Q_4 + 4S_3 - e^{\lambda}\dot{\lambda}) +$$

$$2Q_9' - 8S_2'] + (2r + Q_9 - 4S_2)(Q_9 - 2r - e^{-\lambda}r^2 Q_5 + r^2\lambda')\},$$

$$\tilde{F}_{12} = \tfrac{1}{2r^3}e^{-\frac{1}{2}(\lambda+\nu)}[2Q_8 + r(\dot{Q}_9 - Q_8')],$$

$$\tilde{F}_{13} = -\tfrac{1}{4r^4}[4r^2 - e^{-\lambda}(2r + Q_9 - 4S_2)(2r - 2Q_7 + Q_9 - 4S_2) +$$

$$e^{-\nu}(Q_8 - 4S_4)(-2Q_6 + Q_8 - 4S_4)].$$

In this case Bianchi identities are reduced to 6 following relations:

$$-4r\tilde{F}_{13} + (2r + Q_9 - 4S_2)(\tilde{F}_7 - \tilde{F}_{11}) + 2\tilde{F}_{11}Q_7 +$$

$$e^{\frac{1}{2}(\lambda-\nu)}[(Q_8 - 4S_4)(\tilde{F}_3 - \tilde{F}_9) + 2\tilde{F}_9 Q_6] - 2r^2\tilde{F}_{13}' = 0,$$

$$e^{\frac{1}{2}(\nu-\lambda)}[(\tilde{F}_{10}-\tilde{F}_6)(2r+Q_9-4S_2)-2\tilde{F}_{10}Q_7]+$$

$$(Q_8-4S_4)(\tilde{F}_8-\tilde{F}_2)-2F_8Q_6+2r^2\dot{\tilde{F}}_{13}=0,$$

$$e^{\frac{1}{2}\nu}[\tilde{F}_2(\tfrac{1}{r}Q_9-2-r\nu')+\tfrac{1}{r}\tilde{F}_1(2r-2Q_7+Q_9-4S_2)-2r\tilde{F}'_2]-e^{\frac{1}{2}\lambda-\nu}r\tilde{F}_3Q_0+$$

$$re^{-\frac{1}{2}\nu}[\tilde{F}_2Q_1+\tilde{F}_7(-Q_1-4S_1+e^{\nu}\nu')]+e^{\frac{1}{2}\lambda}\{\tfrac{1}{r}[-\tilde{F}_3Q_8+(\tilde{F}_{12}-\tilde{F}_0)(2Q_6-$$

$$Q_8+4S_4)]+r(2\dot{\tilde{F}}_3+\tilde{F}_3\dot{\lambda})\}-e^{-\frac{1}{2}\lambda}r\tilde{F}_6(-2Q_3+Q_4-4S_3+e^{\lambda}\dot{\lambda})=0,$$

$$e^{\frac{1}{2}\nu}\{\tilde{F}_6(-2-r\nu')-2r\tilde{F}'_6+\tfrac{1}{r}[\tilde{F}_6Q_9+(\tilde{F}_{12}+\tilde{F}_5)(2r-2Q_7+Q_9-4S_2)]\}+$$

$$e^{-\frac{1}{2}\nu}r\tilde{F}_3(-Q_1+2Q_2-4S_1+e^{\nu}\nu')+e^{-\frac{1}{2}\lambda}r[\tilde{F}_7Q_4-\tilde{F}_2(Q_4-4S_3+e^{\lambda}\dot{\lambda})]-$$

$$e^{-\lambda+\frac{1}{2}\nu}r\tilde{F}_6Q_5+e^{\frac{1}{2}\lambda}\{\tfrac{1}{r}[-\tilde{F}_7Q_8-\tilde{F}_4(2Q_6-Q_8+4S_4)]+2r\dot{\tilde{F}}_7+r\tilde{F}_7\dot{\lambda}\}=0, \tag{15}$$

$$e^{\frac{1}{2}\nu}\{2\tilde{F}_8+\tfrac{1}{r}[\tilde{F}_8Q_9-\tilde{F}_4(2r+Q_9-4S_2)]+2r\tilde{F}'_8+r\nu'(\tilde{F}_8-\tilde{F}_{11})\}+$$

$$e^{-\frac{1}{2}\nu}r[\tilde{F}_8Q_1+\tilde{F}_{11}(Q_1-2Q_2+4S_1)]-e^{\frac{1}{2}\lambda-\nu}r\tilde{F}_9Q_0+e^{\frac{1}{2}\lambda}\{\tfrac{1}{r}[(\tilde{F}_{12}-$$

$$\tilde{F}_0)(Q_8-4S_4)-\tilde{F}_9Q_8]-2r\dot{\tilde{F}}_9+r\dot{\lambda}(\tilde{F}_{10}-\tilde{F}_9)\}+e^{-\frac{1}{2}\lambda}r\tilde{F}_{10}(Q_4-4S_3)=0,$$

$$e^{\frac{1}{2}\nu}\{\tfrac{1}{r}[(\tilde{F}_{12}+\tilde{F}_5)(2r+Q_9-4S_2)-\tilde{F}_{10}Q_9]-2\tilde{F}_{10}-2r\tilde{F}'_{10}+r\nu'(\tilde{F}_9-\tilde{F}_{10})\}-$$

$$e^{-\frac{1}{2}\nu}r\tilde{F}_9(Q_1+4S_1)+e^{-\lambda+\frac{1}{2}\nu}r\tilde{F}_{10}Q_5+e^{\frac{1}{2}\lambda}\{\tfrac{1}{r}[\tilde{F}_{11}Q_8+\tilde{F}_1(Q_8-4S_4)]+$$

$$2r\dot{\tilde{F}}_{11}+r\dot{\lambda}(\tilde{F}_{11}-F_8)\}-e^{-\frac{1}{2}\lambda}r[\tilde{F}_{11}Q_4+\tilde{F}_8(Q_4-2Q_3-4S_3)]=0.$$

Now let us consider spherically-symmetric gravitational fields in the frame of MAGT corresponding to particular gravitational Lagrangian:

$$L_G=f_0F+fF^2+aS_{\nu\mu\alpha}S^{\alpha\mu\nu}+kQ_{\mu\nu\lambda}Q^{\mu\lambda\nu}+mQ^{\alpha}{}_{\lambda\alpha}S_{\beta}{}^{\beta\lambda}, \tag{16}$$

where $f_0=(16\pi G)^{-1}$, G is Neuton's gravitational constant; $f,a,k,m$ are indefinite parameters, $F=F^{\mu\nu}{}_{\mu\nu}$.

The gravitational equations can be obtained by variation of total action integral

$$I=\int\delta^4xh(L_G+L_m) \tag{17}$$

($L_m$ is Lagrangian of matter and $h=det(h^i{}_\mu)$) with respect t $h^i{}_\mu$ and $A^{ik}{}_\mu$. As result of variation we get 16 h-equations:

$$H_i{}^\mu-\nabla_\nu\sigma_i{}^{\mu\nu}=t_i{}^\mu, \tag{18}$$

and 64 A-equations:

$$2\nabla_\nu\varphi_{ik}{}^{\nu\mu}+\sigma_{ik}{}^\mu=-J_{ik}{}^\mu, \tag{19}$$

were $H_i{}^\mu = h^{-1}(\delta L_G/\delta h^i{}_\mu)$, $\sigma_i{}^{\mu\nu} = (\partial L_G/\partial S^i{}_{\mu\nu})$, $\varphi_{ik}{}^{\mu\nu} = (\partial L_G/\partial F^{ik}{}_{\mu\nu})$, $t_i{}^\mu = -h^{-1}(\delta L_m/\delta h^i{}_\mu)$, $J_{ik}{}^\mu = -h^{-1}(\delta L_m/\delta A^{ik}{}_\mu)$.

In spherically-symmetric case with vanishing pseudoscalar torsion and nonmetricity functions the system of gravitational equations $(18)-(19)$ is reduced to 19 differential equations:

$$2f_0(\tilde{F}_{19}-\tilde{F}_{20}-\tilde{F}_{17})+f[4\tilde{F}_{19}^2-\tilde{F}_{14}^2-(2\tilde{F}_1-\tilde{F}_4)^2+4(\tilde{F}_{20}+\tilde{F}_{17})^2-$$

$$8\tilde{F}_{19}(\tilde{F}_{20}+\tilde{F}_{17})+4\tilde{F}_8(2\tilde{F}_1-\tilde{F}_4)-4\tilde{F}_8^2+2\tilde{F}_{14}(\tilde{F}_4-2\tilde{F}_1+2\tilde{F}_8)]+$$

$$k\{e^{-\lambda-2\nu}Q_2^2-e^{-3\nu}Q_0^2+e^{-2\lambda-\nu}Q_3^2-e^{-3\lambda}Q_5^2+\tfrac{1}{r^4}[2e^{-\nu}Q_6^2-$$

$$2e^{-\lambda}Q_7(Q_7+2Q_9)]\}+\tfrac{m}{4}\{e^{-\lambda-2\nu}(Q_1Q_2+4Q_2S_1-Q_0Q_4)+$$

$$\tfrac{4}{r}(e{-}\lambda-\nu Q_2-e^{-2\lambda}Q_5)+e^{-2\lambda-\nu}(Q_3Q_4-Q_1Q_5-4Q_3S_3)+$$

$$\tfrac{2}{r^2}[e^{-\lambda-\nu}(Q_4Q_6-4Q_6S_3-Q_1Q_7+Q_3Q_8-4Q_3S_4)-$$

$$e^{-2\nu}Q_0Q_8+4e^{-2\lambda}Q_5S_2+e^{-\nu}Q_6\dot{\lambda}-2e^{-\lambda}Q_7'+e^{-\lambda}Q_7\lambda']+$$

$$\tfrac{4}{r^4}[e^{-\nu}Q_6(Q_8-4S_4)+4e^{-\lambda}Q_7S_2]+e^{-2\nu}Q_0\dot{\lambda}+$$

$$e^{-2\lambda}(3Q_5\lambda'-2Q_5')+e^{-\lambda-\nu}(Q_3\dot{\lambda}+2Q_2'-Q_2\lambda'-2Q_2\nu')\}+$$

$$\tfrac{a}{2}\{e^{-\lambda-\nu}(\tfrac{4}{r}S_1-S_3\dot{\lambda}+2S_1'-S_1\lambda'-2S_1\nu')+e^{-\lambda-2\nu}(Q_1S_1+$$

$$2S_1^2)-\tfrac{1}{r^4}[4e^{-\lambda}S_2^2+2e^{-\nu}(Q_8S_4-2S_4^2)]+e^{-2\lambda-\nu}(2S_3^2-Q_4S_3)\}=t_{\hat{0}}{}^{\hat{0}},$$

$$(\tilde{F}_5-\tilde{F}_{18})[2f_0+4f(2\tilde{F}_{19}-\tilde{F}_{14}-2\tilde{F}_{20}-2\tilde{F}_1+\tilde{F}_4-2\tilde{F}_{17}+$$

$$2\tilde{F}_8)]+2k[e^{-\frac{1}{2}(\lambda+5\nu)}Q_0Q_2-e^{-\frac{3}{2}(\lambda+\nu)}Q_2(Q_3+Q_4)+$$

$$e^{-\frac{1}{2}(5\lambda+\nu)}Q_4Q_5+\tfrac{2}{r^4}e^{-\frac{1}{2}(\lambda+\nu)}Q_7Q_8]+\tfrac{m}{4}\{e^{-\frac{1}{2}(\lambda+5\nu)}Q_0(Q_2-$$

$$Q_1-4S_1)+e^{-\frac{3}{2}(\lambda+\nu)}(Q_3Q_1-2Q_3Q_2+Q_0Q_5+4S_1Q_3-$$

$$4S_1Q_4+4Q_2S_3)+\tfrac{1}{r^2}e^{-\frac{1}{2}(\lambda+3\nu)}[2Q_6(Q_1-2Q_2+4S_1)+$$

$$2Q_0Q_7+2Q_2Q_8+8Q_2S_4+r^2(Q_2\dot{\lambda}-2\dot{Q}_2+2Q_2\dot{\nu}+Q_0\nu')]+$$

$$e^{-\frac{1}{2}(3\lambda+\nu)}[2\dot{Q}_5-3Q_5\dot{\lambda}-\tfrac{1}{r^2}(2Q_5Q_8+Q_4S_2)-Q_3\nu']+$$

$$\tfrac{1}{r^2}e^{-\frac{1}{2}(\lambda+\nu)}(4\dot{Q}_7-\tfrac{4}{r^2}Q_7Q_8-2Q_7\dot{\lambda}-Q_6\nu')\}+$$

$$\tfrac{a}{2}[\tfrac{2}{r^4}e^{-\frac{1}{2}(\lambda+\nu)}Q_8S_2-e^{-\frac{1}{2}(\lambda+5\nu)}Q_0S_1+e^{-\frac{3}{2}(\lambda+\nu)}S_3(2Q_2-Q_1-4S_1)+$$

$$e^{-\frac{1}{2}(\lambda+3\nu)}(S_1\dot{\lambda}-2\dot{S}_1+2S_1\dot{\nu})+e^{-\frac{1}{2}(3\lambda+\nu)}S_3\nu']=t_{\hat{1}}{}^{\hat{0}},$$

$$2(\tilde{F}_{15}-\tilde{F}_9)[f_0+2f(2\tilde{F}_{19}-\tilde{F}_{14}-2\tilde{F}_{20}-2\tilde{F}_1+2\tilde{F}_4-2\tilde{F}_{17}+$$
$$2\tilde{F}_8)]+2k[e^{-\frac{3}{2}(\lambda+\nu)}Q_3(O_1+Q_2)-e^{-\frac{1}{2}(\lambda+5\nu)}Q_0Q_1-$$
$$e^{-\frac{1}{2}(5\lambda+\nu)}Q_3Q_5-\frac{2}{r^4}e^{-\frac{1}{2}(\lambda+\nu)}Q_6Q_9]+\frac{m}{4}\{e^{-\frac{3}{2}(\lambda+\nu)}(2Q_2Q_3-$$
$$Q_2Q_4-Q_0Q_5+4Q_3S_1-4Q_1S_3+4Q_2S_3)+e^{-\frac{1}{2}(5\lambda+\nu)}Q_5(Q_4-Q_3-4S_3)+$$
$$e^{-\frac{1}{2}(\lambda+\nu)}[\frac{8}{r^3}Q_6+\frac{4}{r^4}Q_6Q_9+\frac{2}{r^2}(Q_7\dot{\lambda}-2Q_6'+Q_6\nu')]+e^{-\frac{1}{2}(3\lambda+\nu)}[\frac{2}{r^2}(Q_5Q_6-$$
$$2Q_3Q_7+Q_4Q_7+Q_3Q_9+4Q_3S_2-4Q_7S_3)+Q_5\dot{\lambda}-2Q_3'+2Q_3\lambda'+Q_3\nu']+$$
$$e^{-\frac{1}{2}(\lambda+3\nu)}[2Q_0'-3Q_0\nu'-\frac{2}{r^2}(Q_0Q_9+4Q_1S_4)-Q_2\dot{\lambda}]\}+\frac{a}{2}[e^{-\frac{3}{2}(\lambda+\nu)}S_1(2Q_3-$$
$$Q_4+4S_3)+e^{-\frac{1}{2}(3\lambda+\nu)}(\frac{4}{r}S_3+2S_3'+2S_3\lambda'-S_3\nu')+e^{-\frac{1}{2}(\lambda+\nu)}Q_5S_3-$$
$$e^{-\frac{1}{2}(\lambda+\nu)}(\frac{4}{r^3}S_4+\frac{2}{r^4}Q_9S_4)-e^{-\frac{1}{2}(\lambda+3\nu)}S_1\dot{\lambda}]=t_{\hat{0}}{}^{\hat{1}},$$
$$2f_0(\tilde{F}_8-\tilde{F}_1-\tilde{F}_{20})+f[8\tilde{F}_{20}\tilde{F}_1-\tilde{F}_{14}^2-4\tilde{F}_{19}^2+4\tilde{F}_1^2-4\tilde{F}_{19}(\tilde{F}_4-2\tilde{F}_{17})+$$
$$2\tilde{F}_{14}(2\tilde{F}_{19}+\tilde{F}_4-2\tilde{F}_7)-(\tilde{F}_4-2\tilde{F}_{17})^2-8\tilde{F}_1\tilde{F}_8+4(\tilde{F}_{20}-\tilde{F}_8)^2]+$$
$$k[e^{-3\nu}Q_0^2-e^{-\lambda-2\nu}Q_2^2-e^{-2\lambda-\nu}Q_3^2+e^{-3\lambda}Q_5^2+\frac{1}{r^4}e^{-\nu}(2Q_6^2+4Q_6Q_8)-$$
$$\frac{2}{r^4}e^{-\lambda}Q_7^2]+m\{e^{-\lambda-\nu}[\frac{1}{r}Q_2-\frac{1}{2r^2}(Q_4Q_6-Q_1Q_7-Q_2Q_9-4Q_7S_1+$$
$$4Q_2S_2)+\frac{1}{2}\dot{Q}_3-\frac{1}{2}Q_3\dot{\lambda}-\frac{1}{4}Q_3\dot{\nu}+\frac{1}{4}Q_2\nu']+$$
$$\frac{1}{4}e^{-\lambda-2\nu}(Q_0Q_4-Q_1Q_2-4Q_2S_1)+\frac{1}{4}e^{-2\lambda-\nu}(Q_1Q_5-Q_3Q_4+$$
$$4Q_3S_3)-e^{-2\lambda}Q_5(\frac{1}{r}+\frac{1}{2r^2}Q_9+\frac{1}{4}\nu')+e^{-\lambda}Q_7(\frac{4}{r^4}S_2-\frac{2}{r^3}-\frac{1}{r^4}Q_9-\frac{1}{2r^2}\nu')+$$
$$e^{-2\nu}(\frac{2}{r^2}Q_0S_4-\frac{1}{2}\dot{Q}_0+\frac{3}{4}Q_0\dot{\nu})+\frac{1}{r^2}e^{-\nu}(\dot{Q}_6-\frac{4}{r^2}Q_6S_4-\frac{1}{2}Q_6\dot{\nu})\}+a[\frac{1}{r^3}e^{-\lambda}S_2(2+$$
$$\frac{1}{r}Q_9-\frac{2}{r}S_2)-e^{-\lambda-2\nu}(\frac{1}{2}Q_1S_1+S_1^2)+e^{-2\lambda-\nu}(\frac{1}{2}Q_4S_3-S_3^2)+\frac{2}{r^4}e^{-\nu}S_4^2+$$
$$e^{-\lambda-\nu}(S_3\dot{\lambda}-\dot{S}_3+\frac{1}{2}S_3\dot{\nu}+\frac{1}{2}S_1\nu')]=t_{\hat{1}}{}^{\hat{1}},$$

$$f_0(\tilde{F}_4-\tilde{F}_1+\tilde{F}_{19}-\tilde{F}_{17}+\tilde{F}_8-\tilde{F}_{14})+f[\tilde{F}_{14}^2-4\tilde{F}_{20}^2-$$

$$4\tilde{F}_{20}\tilde{F}_1-2\tilde{F}_1\tilde{F}_4+\tilde{F}_4^2+(4\tilde{F}_{20}+2\tilde{F}_4)(\tilde{F}_{19}-\tilde{F}_{17}+\tilde{F}_8)-$$

$$2\tilde{F}_{14}(\tilde{F}_{19}-\tilde{F}_1+\tilde{F}_4-\tilde{F}_{17}+\tilde{F}_8)]+k[e^{-3\nu}Q_0^2-$$

$$e^{-\lambda-2\nu}(2Q_1Q_2+Q_2^2)+e^{-2\lambda-\nu}(Q_3^2+2Q_3Q_4)-e^{-3\lambda}Q_5^2+\tfrac{2}{r^4}e^{-\nu}Q_6Q_8-$$

$$\tfrac{2}{r^4}e^{-\lambda}Q_7Q_9]+m\{e^{-\lambda-\nu}[\tfrac{1}{2r}Q_2+\tfrac{1}{r^2}(Q_7S_1-\tfrac{1}{4}Q_3Q_8-\tfrac{1}{4}Q_2Q_9-$$

$$Q_2S_2-Q_6S_3-Q_3S_4)+\tfrac{1}{2}\dot{Q}_3-\tfrac{1}{4}Q_3\dot{\lambda}-\tfrac{1}{4}Q_3\dot{\nu}+\tfrac{1}{2}Q_2'-$$

$$\tfrac{1}{4}Q_2\lambda'-\tfrac{1}{4}Q_2\nu']+e^{-2\lambda}[Q_5(\tfrac{1}{4r^2}Q_9+\tfrac{1}{r^2}S_2-\tfrac{1}{2r}+$$

$$\tfrac{3}{4}\lambda'-\tfrac{1}{4}\nu')-\tfrac{1}{2}Q_5']+e^{-\lambda}[Q_7(\tfrac{1}{r^3}+\tfrac{1}{2r^4}Q_9+$$

$$\tfrac{1}{2r^2}\lambda'-\tfrac{1}{2r^2}\nu')-\tfrac{1}{r^2}Q_7']+e^{-2\nu}[Q_0(\tfrac{1}{4r^2}Q_8+\tfrac{1}{r^2}S_4-\tfrac{1}{4}\dot{\lambda}+\tfrac{3}{4}\dot{\nu})-$$

$$\tfrac{1}{2}\dot{Q}_0]+\tfrac{1}{2r^2}e^{-\nu}[2\dot{Q}_6+Q_6(\dot{\lambda}-\dot{\nu}-\tfrac{1}{r^2}Q_8)]+e^{-\lambda-2\nu}(Q_0S_3-Q_2S_1)+$$

$$e^{-2\lambda-\nu}(Q_5S_1-Q_3S_3)\}+a[\tfrac{1}{2r^2}e^{-\lambda}(2S_2'-S_2\lambda'+S_2\nu'-\tfrac{2}{r}S_2-\tfrac{1}{r^2}Q_9S_2)-$$

$$e^{-\lambda-2\nu}S_1^2+e^{-2\lambda-\nu}S_3^2+\tfrac{1}{2r^2}e^{-\nu}(\tfrac{1}{r^2}Q_8S_4-2\dot{S}_4-S_4\dot{\lambda}+S_4\dot{\nu})]=t_{\hat{2}}{}^{\hat{2}},$$

$$4e^{-\frac{3}{2}\nu}kQ_0+(e^{-\lambda-\frac{1}{2}\nu}Q_3+\tfrac{2}{r^2}e^{-\frac{1}{2}\nu}Q_6)[f_0+2f(2F_{19}-F_{14}-2F_{20}-$$

$$2F_1+F_4-2F_{17}+2F_8)]=J_{00}{}^0,$$

$$-\tfrac{1}{2}e^{-\frac{1}{2}\lambda-\nu}Q_2[2f_0+4f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)-$$

$$1+8k]-\tfrac{1}{2}e^{-\frac{3}{2}\lambda}Q_5-\tfrac{1}{r^2}e^{-\frac{1}{2}\lambda-\nu}(e^{\nu}Q_7-ar^2S_1)=J_{00}{}^1,$$

$$\tfrac{1}{2}e^{-\frac{1}{2}\lambda-\nu}[4k(Q_1+Q_2)+2aS_1]+[\tfrac{1}{2}e^{-\frac{1}{2}\lambda-\nu}Q_1+\tfrac{1}{2}e^{-\frac{3}{2}\lambda}Q_5+\tfrac{1}{r^2}e^{-\frac{1}{2}\lambda}(2Q_7-Q_9+$$

$$4S_2)][f_0+2f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)]+2fe^{-\frac{1}{2}\lambda}(2F_{19}'-$$

$$F_{14}'-2F_{20}'-2F_1'+F_4'-2F_{17}'+2F_8')=J_{01}{}^0,$$

$$[\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}(Q_8-2S_4)-\tfrac{1}{2}e^{-\frac{3}{2}\nu}Q_0-\tfrac{1}{2}e^{-\lambda-\frac{1}{2}\nu}Q_4][f_0+2f(2F_{19}-F_{14}-2F_{20}-$$

$$2F_1+F_4-2F_{17}+2F_8)]-2e^{-\lambda-\frac{1}{2}\nu}k(Q_3+Q_4)+\tfrac{1}{2}e^{-\lambda-\frac{1}{2}\nu}S_3+\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}S_4-$$

$$fe^{-\frac{1}{2}\nu}(2\dot{F}_{19}-\dot{F}_{14}-2\dot{F}_{20}-2\dot{F}_1+\dot{F}_4-2\dot{F}_{17}+2\dot{F}_8)=J_{01}{}^1,$$

$$(\tfrac{1}{2}e^{-\lambda-\frac{1}{2}\nu}Q_4-\tfrac{1}{2}e^{-\frac{3}{2}\nu}Q_0-2e^{-\lambda-\frac{1}{2}\nu}S_3-\tfrac{2}{r^2}e^{-\frac{1}{2}\nu}S_4)[f_0+2f(2F_{19}-F_{14}-2F_{20}-$$

$$2F_1+F_4-2F_{17}+2F_8)]-\tfrac{2}{r^2}e^{-\frac{1}{2}\nu}k(Q_6+Q_8)+\tfrac{4}{r^2}e^{-\frac{1}{2}\nu}S_4+2e^{-\lambda-\frac{1}{2}\nu}S_3-$$

$$2fe^{-\frac{1}{2}\nu}(2\dot{F}_{19}-\dot{F}_{14}-2\dot{F}_{20}-2\dot{F}_1+\dot{F}_4-2\dot{F}_{17}+2\dot{F}_8)=J_{02}{}^2,$$

$$
\begin{aligned}
&(\tfrac{1}{2}e^{-\frac{1}{2}\lambda-\nu}Q_1+\tfrac{1}{2}e^{-\frac{3}{2}\lambda}Q_5+\tfrac{1}{r^2}e^{-\frac{1}{2}\lambda}Q_9-\tfrac{4}{r^2}e^{-\frac{1}{2}\lambda}S_2)[f_0+2f(2F_{19}-F_{14}-2F_{20}-\\
&2F_1+F_4-2F_{17}+2F_8)]+2e^{-\frac{1}{2}\lambda-\nu}k(Q_1+Q_2)-2fe^{-\frac{1}{2}\lambda}(2F'_{19}-F'_{14}-\\
&2F'_{20}-2F'_1+F'_4-2F'_{17}+2F'_8)={J_{10}}^0,\\
&[\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}(2Q_6-Q_8+4S_4)-\tfrac{1}{2}e^{-\frac{3}{2}\nu}Q_0-\tfrac{1}{2}e^{-\lambda-\frac{1}{2}\nu}Q_4][f_0+\\
&2f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)]+\\
&2fe^{-\frac{1}{2}\nu}(2\dot{F}_{19}-\dot{F}_{14}-2\dot{F}_{20}-2\dot{F}_1+\dot{F}_4-2\dot{F}_{17}+2\dot{F}_8)+\tfrac{1}{2}e^{-\frac{3}{2}\nu}Q_0-\\
&\tfrac{1}{2}e^{-\lambda-\frac{1}{2}\nu}[Q_3(1+4k)+4kQ_4-2S_3(1+a)]+\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}(2S_4-Q_6)={J_{10}}^1,\\
&e^{-\lambda-\frac{1}{2}\nu}Q_3[f_0+2f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)]+\\
&e^{-\lambda-\frac{1}{2}\nu}(4kQ_3+aS_3)={J_{11}}^0,\\
&(\tfrac{2}{r^2}e^{-\frac{1}{2}\lambda}Q_7-e^{-\frac{1}{2}\lambda-\nu}Q_2)[f_0+2f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-\\
&2F_{17}+2F_8)]-4e^{-\frac{3}{2}\lambda}kQ_5-2e^{-\frac{1}{2}\lambda-\nu}S_1-\tfrac{4}{r^2}e^{-\frac{1}{2}\lambda}S_2={J_{11}}^1,\\
&[\tfrac{1}{2}e^{-\frac{3}{2}\lambda}Q_5-\tfrac{1}{2}e^{-\frac{1}{2}\lambda-\nu}(Q_1+4S_1)-\tfrac{2}{r^2}e^{-\frac{1}{2}\lambda}S_2][f_0+2f(2F_{19}-F_{14}-\\
&2F_{20}-2F_1+F_4-2F_{17}+2F_8)]-2fe^{-\frac{1}{2}\lambda}(2F'_{19}-F'_{14}-2F'_{20}-2F'_1+\\
&F'_4-2F'_{17}+2F'_8)+\tfrac{2}{r^2}e^{-\frac{1}{2}\lambda}[2S_2-k(Q_7+Q_9)]+2e^{-\frac{1}{2}\lambda-\nu}S_1={J_{12}}^2,\\
&[\tfrac{1}{2}e^{-\lambda-\frac{1}{2}\nu}(2Q_3-Q_4+4S_3)-\tfrac{1}{2}e^{-\frac{3}{2}\nu}Q_0+\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}(Q_6-Q_8+2S_4)][f_0+\\
&2f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)]+2fe^{-\frac{1}{2}\nu}(2\dot{F}_{19}-\\
&\dot{F}_{14}-2\dot{F}_{20}-2\dot{F}_1+\dot{F}_4-2\dot{F}_{17}+2\dot{F}_8)+e^{-\frac{3}{2}\nu}Q_0+e^{-\lambda-\frac{1}{2}\nu}(2S_3-Q_3)+\\
&\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}[2Q_8-2Q_6(1+k)+S_4(1+a)]={J_{20}}^2,\\
&[f_0+2f(2F_{19}-F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)]\\
&[e^{-\frac{1}{2}\lambda-\nu}(\tfrac{1}{2}Q_1-Q_2+2S_1)+\tfrac{1}{2}e^{-\frac{3}{2}\lambda}Q_5+\tfrac{1}{r^2}e^{-\frac{1}{2}\lambda}(Q_7-\\
&Q_9+2S_2)]+2fe^{-\frac{1}{2}\lambda}(2F'_{19}-F'_{14}-2F'_{20}-2F'_1+F'_4-\\
&2F'_{17}+2F'_8)+e^{-\frac{1}{2}\lambda-\nu}(Q_2+2S_1)-e^{-\frac{3}{2}\lambda}Q_5-\\
&\tfrac{1}{r^2}e^{-\frac{1}{2}\lambda}[2Q_7(1+k)+2kQ_9-S_2(4+a)]={J_{21}}^2,\\
&\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}(4kQ_6+aS_4)+\tfrac{1}{r^2}e^{-\frac{1}{2}\nu}Q_6[f_0+2f(2F_{19}-\\
&F_{14}-2F_{20}-2F_1+F_4-2F_{17}+2F_8)]={J_{22}}^0,
\end{aligned}
\tag{20}
$$

$$\tfrac{1}{2}e^{-\frac{3}{2}\lambda}Q_5 - \tfrac{1}{2}e^{-\frac{1}{2}\lambda-\nu}Q_2 - \tfrac{1}{r^2}e^{-\frac{1}{2}\lambda}[Q_7(4k-1) + aS_2] -$$
$$\tfrac{1}{r^2}e^{-\frac{1}{2}\lambda}Q_7[f_0 + 2f(2F_{19} - F_{14} - 2F_{20} - 2F_1 + F_4 - 2F_{17} + 2F_8)] = J_{22}{}^1.$$

In the case $t_i{}^\mu = 0$, $J_{ik}{}^\mu = 0$ this system of equations is satisfied by vanishing torsion and nonmetricity and vacuum Schwarzchild metrics:

$$g_{\mu\nu} = \mathrm{diag}((1 - r_g/r), -(1 - r_g/r)^{-1}, -r^2, -r^2\sin^2\theta), (r_g = const). \tag{21}$$

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